REMARKS

Upon entry of the present amendment, claims 1-20 will remain pending in the above-identified application with claims 1-2, 4, 8 and 11-14 standing ready for further action on the merits and claims 3, 5-7 and 9-10 standing withdrawn from consideration based upon an earlier Restriction Requirement.

Claim 1 has been amended. New claim 20 has been added. Support for the amendment to claim 1 and new claim 20 can be found in page 2, lines 23-24 of the specification. Also, claims 17-19 have been amended to "the laser source of the laser beam" as suggested by the Examiner. No new matter is being introduced by the present amendments to the claim.

Further, the instant amendment does not raise substantial new issues for the Examiner's consideration nor require further search on the Examiner's part. At the same time, the instant amendments place the pending claims in condition for allowance and into a more proper format for issuance in a United States patent, by overcoming all outstanding rejections and objections of record. As such entry of the instant amendment and favorable action on the merits is earnestly solicited.

Claim Rejections under 35 U.S.C. §112

Claims 17-19 are rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 17-19 have been amended in a fashion that is submitted to obviate and overcome the present rejection (*i.e.*, changing the term *"the laser source of the laser"* to read *"the laser*

source of the laser beam" (emphasis added)). Accordingly, reconsideration and withdrawal of the outstanding rejection are required at present.

Claim Rejections under 35 U.S.C. § 103(a)

Claims 1, 2, 4, 8, 12-14 and 16-19 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Kammler DE '726 (DE 19516726) in view of Dries US '296 (US 2003/0003296).

This rejection is respectfully traversed. Reconsideration and withdrawal thereof are respectfully requested based on following consideration.

Nonobviousness over the Combination of the Cited References

As recited in claim 1, which is currently amended in this reply, the claimed method for sealing a fiber-based material employs the laser beam having a wavelength of not greater than 1500 nm (or 500-1500 nm as recited in claim 20). Neither Kammler DE '726 nor Dries US '296 discloses or suggests employing the laser beam having the claimed wavelength for sealing purposes.

At the section *"Response to Arguments"* in paragraph *"5."* of the Office Action, it is alleged that Ang US '809 (US 4,537,809) and Hull US '559 (US 5,192,559) teach that diode and Nd:YAG lasers are useful to burn or cut the paper. However, Applicants respectfully disagree with the allegation for following reasons.

Hull US '559 teaches at column 9, lines 24-56 that CO_2 laser having a wavelength of 10.6 μm can be used for cutting paper. These teachings are consistent with the paper by Malmberg et al., which was attached to the previous reply filed on October 12, 2010. Hull US

'559 further discloses that diode-pumped Nd:YAG lasers would be suitable for paper, provided that the material (paper) substantially absorbs the wavelength of the laser. However, the wavelength of Nd:YAG lasers (not CO_2 laser) is 1064 nm, not 10.6 μm. When a laser beam having wavelength of 1064 nm is employed in the condition as disclosed in Hull US '559, such a laser beam is not substantially absorbed by paper. Consequently, Nd:YAG laser becomes unsuitable for cutting paper. Thus, Hull US '559 does not provide one skilled in the art with any motivation to employ Nd:YAG lasers for a purpose of cutting paper.

Ang US '809 does not make up for the deficiencies of Hull US '559. Ang US '809 discloses a method of cutting score lines of a fibrous backing. For instance, Kraft paper, synthetic fabrics and polymer films are counted as backing materials (see *e.g.*, column. 3, line 52 to column. 4, line 4 of Ang US '809). When a backing is made of paper, a CO_2 laser having a wavelength of 10.6 μm is preferred as the output since it is completely absorbed by paper (see column 7, lines 46-49). However, Ang US '809 fails to disclose or suggest that Nd:YAG laser is suitable for paper. It is noted that even synthetic fabrics and polymers may form the backing, Ang US '809 expressly teaches that the choice of the laser for scoring depends on the material of the backing (see column 7, lines 44-46). Ang US '809 fails to disclose or suggest that Nd:YAG lasers would be suitable for cutting paper or the solution for sealing paper-based materials as in the present invention.

In general, even Nd:YAG lasers, in spite of the low adsorption at their wavelength, might cut paper if the laser power density is raised greatly. However, such a technique would be extremely wasteful, and would not be contemplated by the skilled person (see also the absorptivity graph by Ojala as discussed below). Thus, neither Hull US '559 nor Ang US '809

suggests cutting paper with a Nd:YAG laser. At most, Hull US '559 and Ang US '809 merely suggest cutting paper by a CO_2 laser with a low power density.

Turning now back to Kammler DE '726 and Dries US '296, both of the cited references also fail to disclose or suggest the claimed invention. If the energy absorbed to the paper is kept low, as taught by Kammler DE '726, the energy is reflected back and the polyethylene coating would not melt and form a seal. If the radiation energy is increased, the paper is cut and the desired sealing cannot be attained.

There is no specific teachings in the cited references as to how the radiation should be transmitted through the paper without damaging it and polymer (*e.g.*, polyethylene) could be melted for the sealing. Kammler DE '726 is silent about the claimed features of the present invention, which are (i) use of a diode or Nd:YAG laser, (ii) a wavelength of not greater than 1500 nm, and (iii) a radiation-absorbing pigment at the sealing area.

Further, the secondary reference Dries US '296 is significantly different from the present invention in the materials to be sealed (*i.e.*, polymer films in Dries US '296). Dries US '296 is silent about how to seal a fibre-based material such as paper or board. Also, Dries US '296 is silent about the specific problems of laser-sealing such materials from the backside (*e.g.*, the radiation energy passing through the paper) and solutions to resolve such problems. Dries US '296 teaches that the laser beam must pass the material being sealed. This is a condition that is easily fulfilled with a polymer film, but cannot be fulfilled with paper as discussed above in connection with Kammler DE '726. Therefore, there is no rationale and/or reasonable expectation of success to arrive the present invention by combining Dries US '296, where paper is treated, and Dries US '296, where a polymer film is treated. (The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior

art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990)).

For support of the remarks as set forth above, there is attached hereto three graphs showing (a) transmissivity, (b) reflectivity and (c) absorptivity as a function of the wavelength in the range of 0.4 to 20.0 μm for five paper grades (1x-5x) having the weights of 41 g/m^2 (1x), 82 g/m^2 (2x), 123 g/m^2 (3x), 164 g/m^2 (4x), and 206 g/m^2 (5x), respectively. It is seen that at wavelengths below 1.5 μm (1500 nm), as used in the present invention, absorption is low, *i.e.* the paper is not burnt, reflection back from the paper is high, and transmission varies from moderate for thin paper (about 30 %) to low for usual paperboard grades (about 5 to 10 %). A low transmission would not melt polymer on the reverse side unless there is added a radiation-absorbing pigment according to the teachings of the present invention. The graphs also make clear why CO_2 laser at the wavelength 10.6 μm is effective for cutting paper (absorption nearly 90 %).

Incidentally, the enclosed graphs are taken from the dissertation of Ojala, K., Studies on infrared drying of paper, use of integrating spheres in FTIR-measurements and heat and mass transfer inside paper, published by Teknillinen Korkeakoulu (=Technical University), Espoo, Finland in 1993. It is noted that the Ojala' paper is merely referred to explain background art for better understanding the present invention, not to limit nor narrow scope of the claims.

Therefore, there is no rationale and/or reasonable expectation of success based on the combination of the cited references, by which one skilled in the art could arrive at the present invention as claimed, since the cited references fail to disclose or suggest each of the instantly claimed features, as explained above. Further, the claimed invention exhibits unexpected,

advantageous properties, as explained above. Thus, it is submitted that the present invention is not obvious over Kammler DE '726 in view of Dries US '296.

Based on the foregoing considerations, Applicants respectfully request that the Examiner withdraw the rejections.

CONCLUSION

All of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. It is believed that a full and complete response has been made to the outstanding Office Action, and as such, the present application is in condition for allowance.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Toyohiko Konno, Registration No. L0053, at the telephone number of the undersigned below to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Director is hereby authorized in this, concurrent, and future replies to charge any fees required during the pendency of the above-identified application or credit any overpayment to Deposit Account No. 02-2448.

Dated: June 6, 2011

Respectfully submitted,

By _____ #32,801
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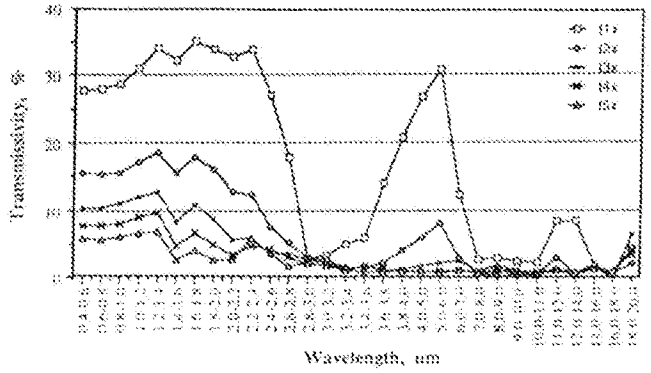
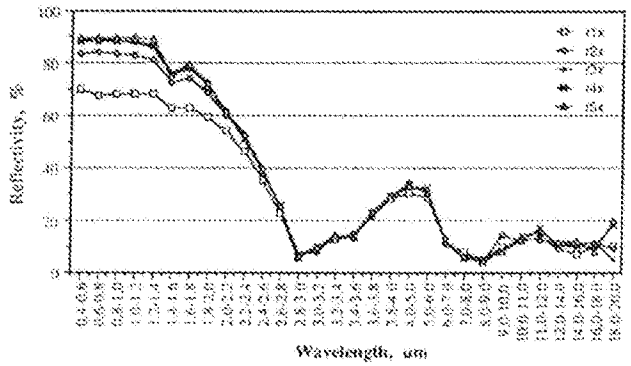
Attachment: Graphs by Ojala (1993) – 1 sheet

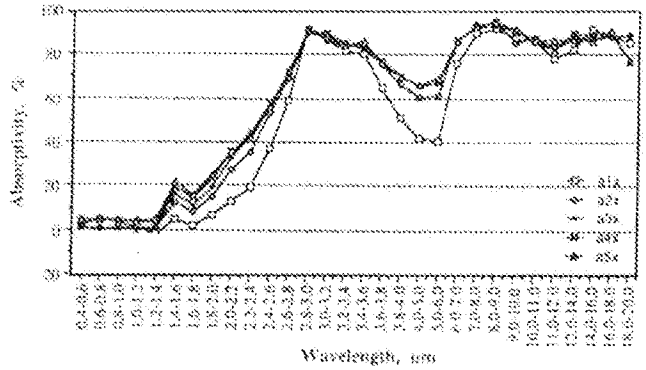
a)


Transmissivity, %
Wavelength, um

b)


Reflectivity, %
Wavelength, um

c)


Absorptivity, %
Wavelength, um